Absolute encoder TBD/TRD with PROFIBUS-DP interface

TWK ELEKTRONIK

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- **Singleturn and multiturn versions**
- **Contactless, wear-free sensor system according to the Hall principle**
- **High vibration and shock resistance thanks to the robust mechanical design**
- **Resolution up to 8192 steps / 360° (13 bit)**
- **Measuring range: 4096 revolutions (12-bit)**
- **Dual-chamber system to separate the rotor and electronics**
- **Protection type: IP 66, IP 69K (on request)**
- **Operating temperature range: - 40°C to + 85°C**
- **Preset button in the connecting cap**

Design and function

Recording of the angular position and revolutions by means of Hall sensors - multiturn version with absolute transmission for up to 4096 revolutions - data output plus parameterisation and diagnosis via Profibus-DP.

Robust housing manufactured from seawater-proof aluminium or stainless steel - stainless steel shaft - ball bearing with radial shaft seal - sensor circuit consisting of ASIC with Hall elements - electrical connections via the connecting cap with threaded cable connections.

The absolute encoders are designed for direct connection to the PROFIBUS-DP. The interface is implemented with the SPC3 Siemens PROFIBUS controller. The protocol corresponds to DP-Slave Class 2 functionality in accordance with Profibus profile for encoders, No. 3.062, and is described in detail in the TRD 12770 user manual.

The TRD is mechanicallly and electrically compatible with the electro-optical encoder CRD.

Profibus characteristics

- Profibus-DP-V0 slave
- Address and terminating resistors can be set in the connecting cap using DIP switches
- Transmission rate of up to 12 MBaud
- Reference value setting via the control system output data and preset button
- Parameterisable via Profibus

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Technical Data

Input data *

- 4 bytes position
- 4 bytes velocity (firmware version 1.02 or higher)

Output data *

- 4 bytes preset

Electrical data

Sensor system:	ASIC with HALL elements
Operating voltage:	+ 13.5 VDC to + 30 VDC (reverse voltage protection)
Power consumption:	< 2 W, switch on current < 250 mA
Auflösung:	Resolution: 4096 steps / 360°≒ (12-bit) or 8192 steps / 360°≒ (13-bit)
Measuring range:	4096 revolutions
Total number of steps:	Max. 25-bit
Absolute accuracy:	± 0.2 % (with reference to one revolution)
Output code:	Binary
Code path:	CW / CCW
Internal updating time	≤ 2 ms

Mechanical data

Operating speed:	1000 rpm max. (optionally up to 4000 rpm)
Angular acceleration:	10^5 rad/s² max.
Moment of inertia (rotor):	20 gcm²
Operating torque:	≤ 8 Ncm (at 500 rpm)
Starting torque:	≤ 4 Ncm
Perm. shaft load:	250 N axial 250 N radial
Bearing service life **:	> 10^9 revolutions
Weight:	ca. 0.450 kg

Environmental data

Operating temperature range:	- 40°C to + 85°C
Storage temperature range:	- 20°C to + 60°C (due to packaging)
Resistance:	
☐ To shock:	500 m/s²; 11 ms DIN EN 60068-2-27
☐ To vibration:	500 m/s²; 10 ... 2000 Hz DIN EN 60068-2-6
EMC standards:	EN 61000-6-2 (interference immunity) EN 61000-6-4 (interference emission) (only with shielded connection cables)
Protection type: (DIN EN 60529)	IP 66, IP 69K (on request)

Electrical connections

- Connecting cap with threaded cable connections for:
  - ☐ Supply voltage (+ UB = 24 VDC, - UB = 0 VDC), threaded cable connection M12x1.5
  - ☐ Bus in (A, B), threaded cable connection M16x1.5
  - ☐ Bus out (A‘, B‘), threaded cable connection M16x1.5

* From the point of view of the control system.

** These values apply at maximum shaft load. Higher values are achievable at lower loads.

Technical Data

Bus-specific data

- Specifications: PROFIBUS-DP-V0, slave subscriber SPC3 Siemens PROFIBUS controller
- Interface: Line driver according to RS 485, galvanically separated via magnetic couplers
- Data rate: 9.6 kBaud to 12 MBaud
- Station address: 1 to 126 can be set using DIP switches, default value: 123
- GSD file: According to Specifications for PROFIBUS Device Description and Device Integration Volume 1: GSD PNO-Order No: 2.122
- Freeze-mode: Is supported
- Sync-mode: Is supported
- Automatic baud rate search: Is supported
- Diagnosis bytes: Class 2: 63 diagnosis bytes *; Class 1: 16 diagnosis bytes
- User-Parameterbytes: Class 2: 32 bytes; Class 1: 2 bytes
- Configuration options: See table below

Configuration options in accordance with PROFIBUS profile for encoders No. 3.062

Configuration	Class	Data	Identifier byte
Class 2 32 bit in/out 32 bit velocity	2	64 bit in/output data	F3
Class 2 32 bit in/out	2	32 bit in/output data	F1
Class 2 16 bit in/out	2	16 bit in/output data	F0
Class 1 32 bit in	1	32 bit input data	D1
Class 1 16 bit in	1	16 bit input data	D0

Programmable parameters

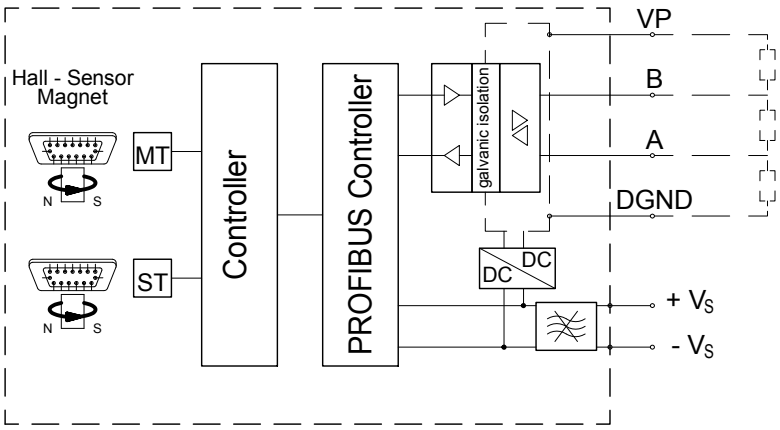
Parameter	Value range	Parameter description
Code sense	CW / CCW	CW (clockwise): ascending values on rotation clockwise CCW (counter clockwise): descending values on rotation clockwise (viewed looking at the shaft)
Scaling function	disable / enable	Enablement of the parameters of resolution and total number of steps
Velocity unit	Steps/10 ms, Steps/100 ms	Only with firmware version 1.02 or higher
Shortened diagnosis	no / yes	Reduction of the number of diagnosis bytes to 16 bytes
Resolution [steps/360°]	1 ... 4096 (8192)	Steps per revolution (360°)
Total number of steps [steps]	1 ... 16,777,216 (33,554,432) singleturn version: 4096 (8192)	Overall measuring range
Reference value	0 ... total number of steps -1	(Programming is done via the output data)

(The values in brackets apply to the TRDxx-xx8192R4096C2ZDxx)

* Shortened diagnosis (16 bytes) can be set.

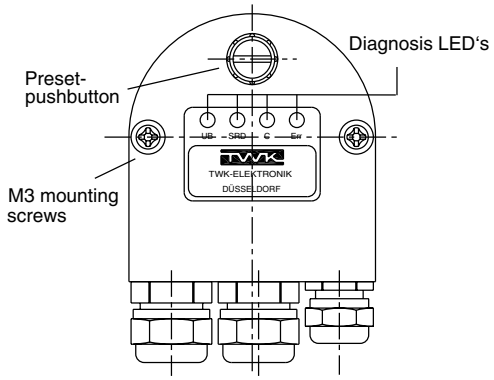
Electrical connection

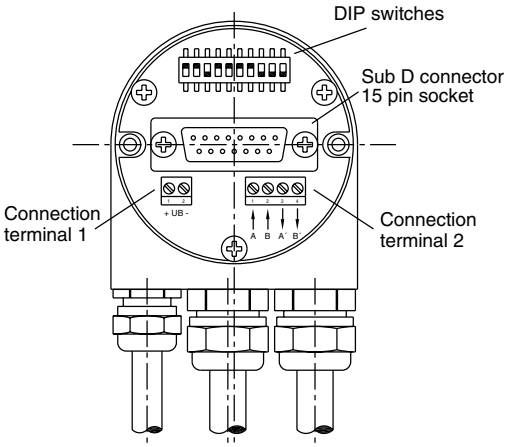
Principle circuit diagram



Connecting cap ZKD

The cap is listed and supplied as a separate order item. It can be separated from the absolute encoder for setting purposes by releasing two screws.





Connection terminal 1:

Designation	Signal
UB+	Supply voltage (24 VDC)
UB-	GND (0 VDC)

Connection terminal 2:

Designation	Signal
A	RXD/TXD-N
B	RXD/TXD-P
A'	RXD/TXD-N
B'	RXD/TXD-P

Electrical connection

Status-LEDs:

Status	UB	SRD	C	Err
Incorrect configuration	x	x		x
Impermissible parameters	x		x	x
Coding error (see diagnosis bytes 62 - 63)	x			x
Class 1 device configuration OK	x	x		
Class 2 device configuration OK	x	x	x	
UB - operating voltage, SRD - data transfer, C - class membership, Err - error message				

Address setting / terminating resistors:

Switch	1	2	3	4	5	6	7	8	9	10
ON = 1	2^0	2^1 ...					2^7	n.c.	Terminating resistors: on	
OFF = 0	Adresses 1 - 126 can be set (123: default adress)								Terminating resistors: off	

Absolute encoder TBD/TRD

Order number

Absolute encoder

TRD	58 -	K	A	4096	R	4096	C2	Z	D	01

Electrical and / or mechanical variants *
- 01 Standard
- 02 Compatible with the encoder model KRD **

D PROFIBUS-DP-V0

Electrical connection:
- Z Connecting cap

Profil:
- C2 Class 2 according to encoder profile No. 3.062

Measuring range:
- 4096 Revolutions

Output code:
- R Binary

Resolution:
- 4096 Steps / 360°
- 8192 Steps / 360°

Housing material:
- A Aluminium
- S Stainless Steel

Design form

Flange:

58	K	Clamped flange, shaft 10 mm with flat
	KF	Clamped flange, shaft 10 mm with woodruff key
	KP	Clamped flange, shaft 10 mm with parallel key (recommended for safety)
	KZ	Clamped flange, shaft for play-compensating toothed gear ZRS
	S	Synchro flange, shaft 6 mm
	SR	Synchro flange, clamping shaft 12 mm (torque plate see accessories)
	ST	Synchro flange, shaft 6 mm with flat
64	NZ	Cam switch flange, shaft for ZRS
65	S	Synchro flange, shaft 12 mm
	SP	Synchro flange, shaft 12 mm with parallel key
66	K	Clamped flange, shaft 10 mm with flat
	KP	Clamped flange, shaft 10 mm with parallel key
90	MP	Mounting flange, shaft 12 mm with parallel key
105	M	Mounting flange, shaft 12 mm
	MP	Mounting flange, shaft 12 mm with parallel key

Model:
- TBD Singleturn encoder
- TRD Multiturn encoder

* The basic versions according to the data sheet bear the number 01. Deviations are identified with a variant number and are documented in the factory.

** The compatibility is only valid for the position value.
The speed value of the TRD is based on a 12 bit position value, but on a 16 bit position value in the KRD.

Order number

Connecting cap

ZKD -	D	01	
			Electrical and / or mechanical variants *
		01	Standard
		34	Housing and cable glands from stainless steel (1.4305) without preset button, protection class IP 68
	D		PROFIBUS-DP-V0
ZKD			Connecting cap for KRD / TRD absolute encoders

Accessories

Accessories (to be ordered separately)

- Documentation on CD

TWK-CD-01	CD-ROM with documentation, device description file, bitmap and example programme

- Couplings

BKK	Folding bellows coupling, large, see data sheet BKK11840
BKM	Folding bellows coupling, small, see data sheet BKM11995
KK14S	Clamp coupling, see data sheet KK12301

- Measuring gear

ZRS	Play compensating measuring gear ZRS11877

- Torque plate

ZMS	See data sheet ZMS12939

- Further installation accessories and securing clamps are available according to data sheet MZ10111 .

Documentation, GSD file, etc.

The following documents plus the GSD file, a bitmap and example programmes can be found in the Internet under www.twk.de in the documentation area, model TRD

- Data sheet No. TRD11868
- User manual No. TRD12770

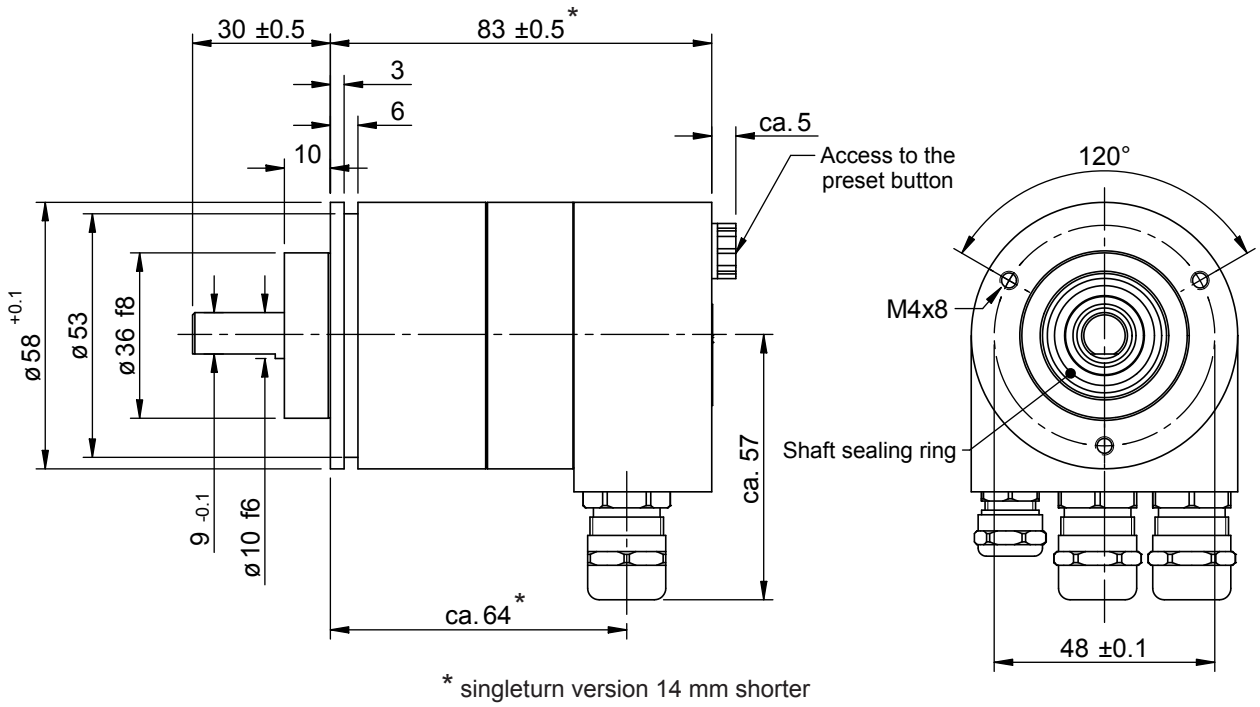
Optionally, a CD-ROM can be supplied. (Please specify article No. TWK-CD-01 on ordering.)

* The basic versions according to the data sheet bear the number 01. Deviations are identified with a variant number and are documented in the factory.

Installation drawing

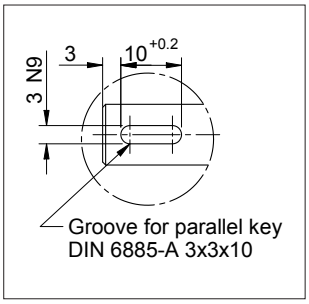
Standard design
Design form 58 with clamped flange, Order name: TRD58-KA4096R4096C2ZD01
Shaft ø 10 mm

Dimensions in mm

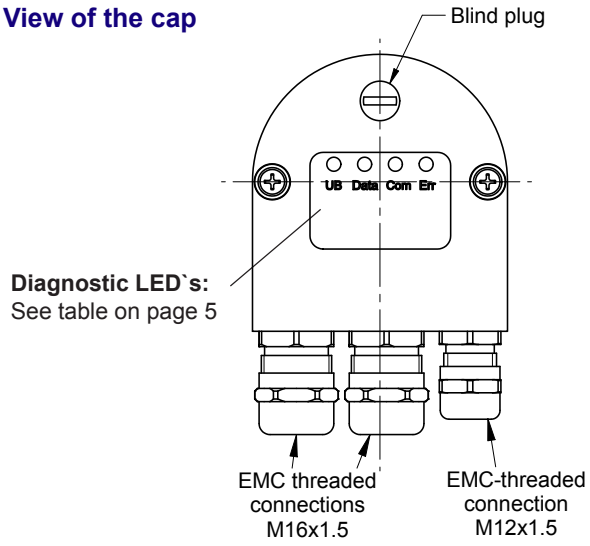


* singleturn version 14 mm shorter

■ Optional: Shaft "P"
groove and parallel key



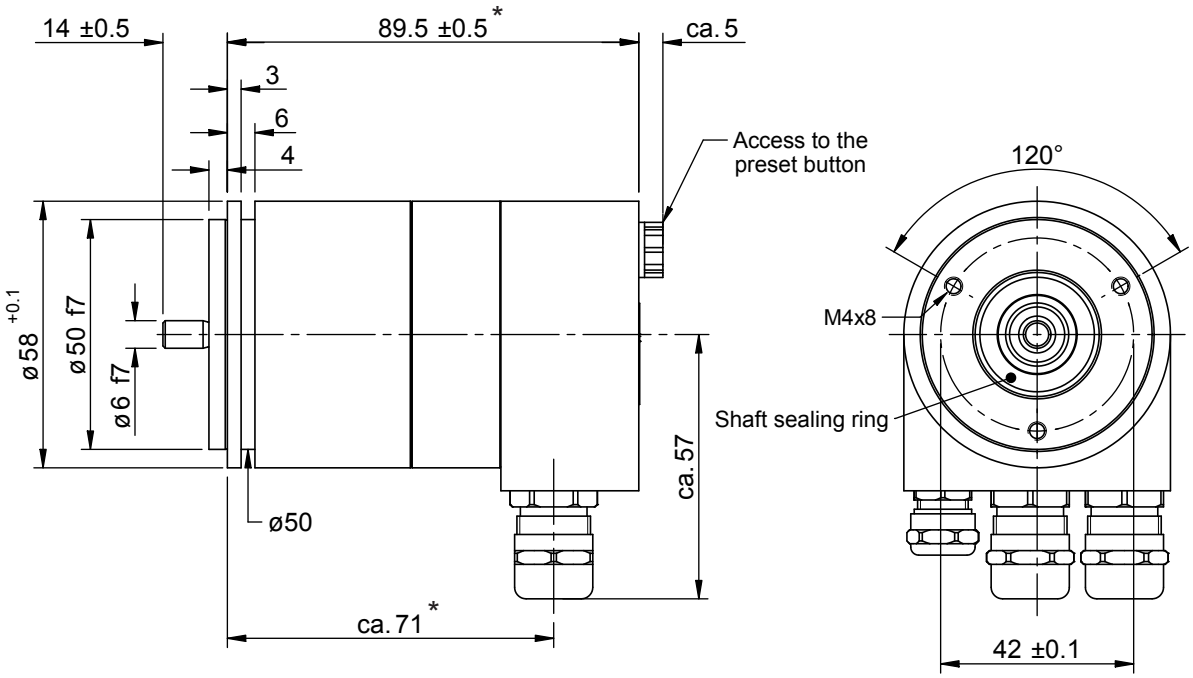
View of the cap



Installation drawing

Other possible design forms
Design form 58 with synchroniser flange, Order name: TRD58-SA4096R4096C2ZD01
Shaft ø 6 mm

Dimensions in mm

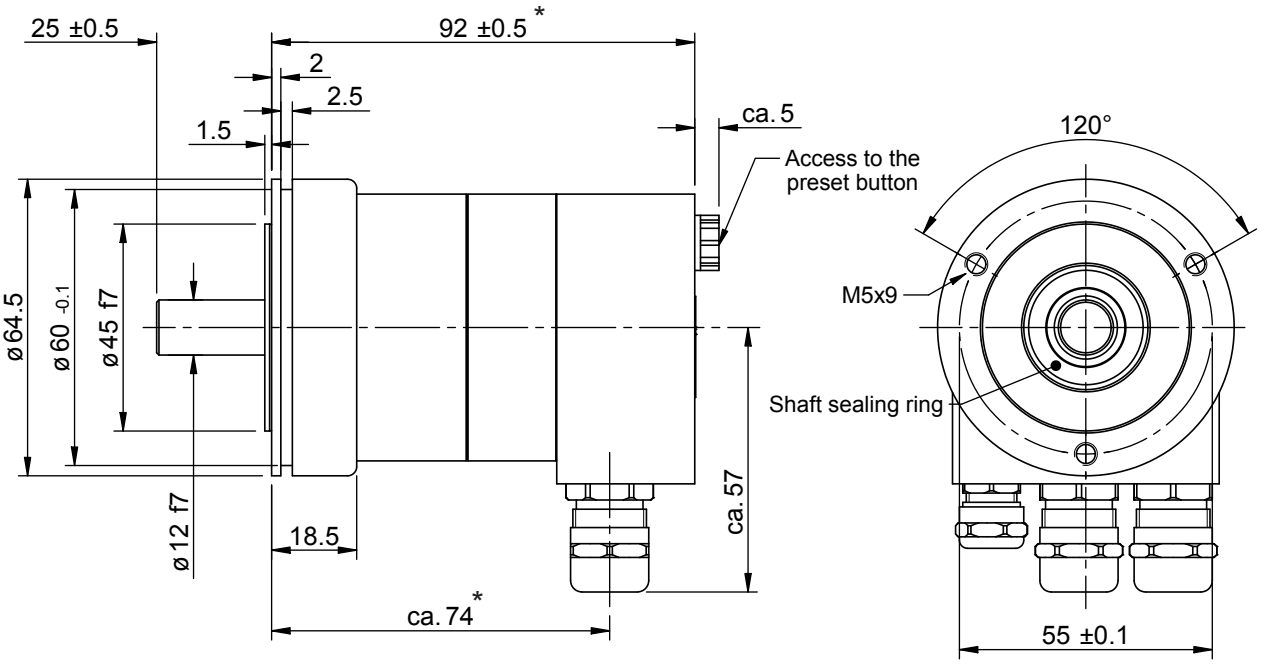


* singleturn version 14 mm shorter

Installation drawing

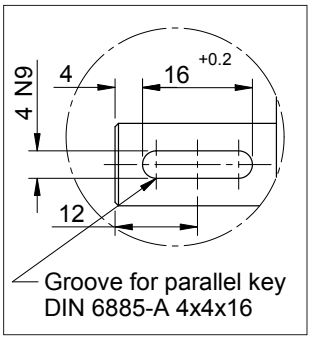
Design form 65 with synchroniser flange, Order name: TRD65-SA4096R4096C2ZD01
Shaft ø 12 mm

Dimensions in mm



* singleturn version 14 mm shorter

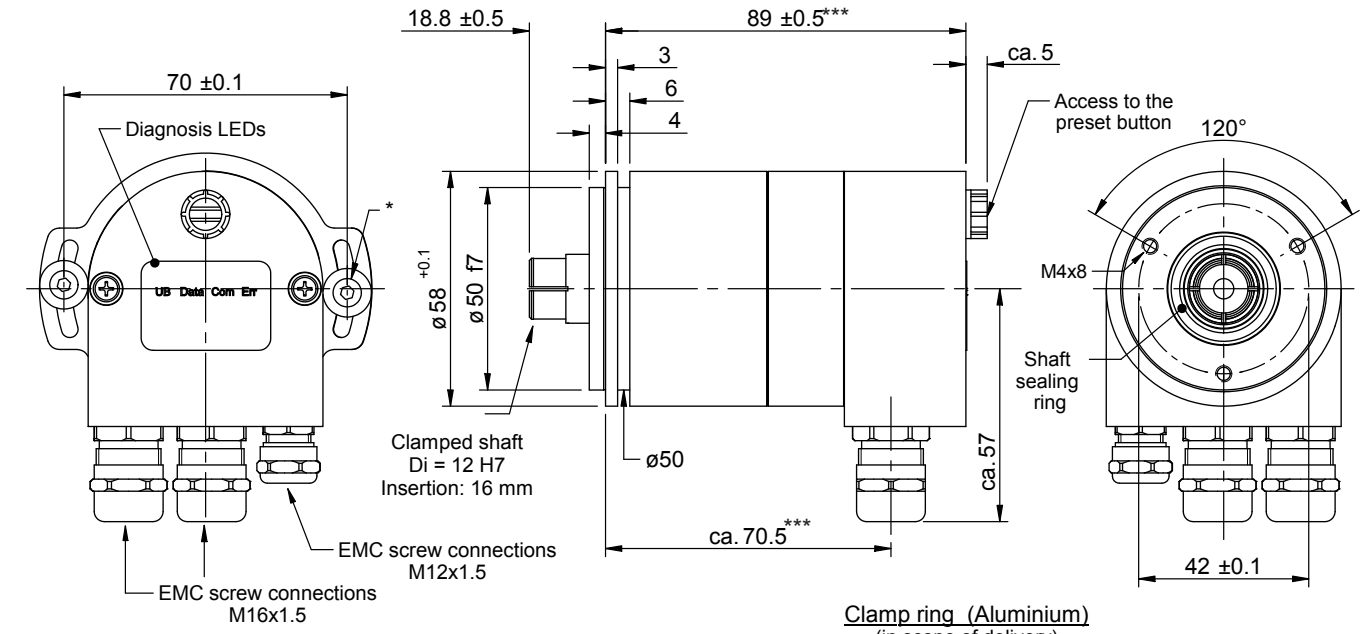
■ Optional: Shaft "P"
groove and parallel key

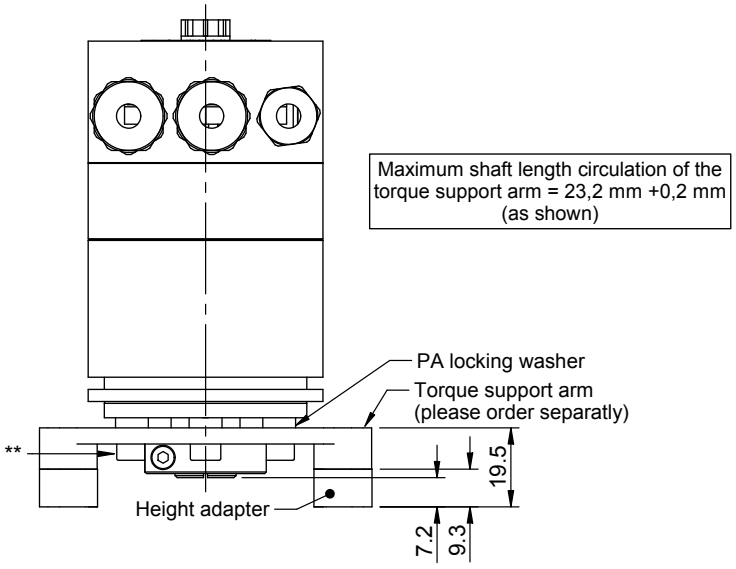


Installation drawing

Design form 58 with synchroniser flange and campled shaft, Order name: TRD58-SRA4096R4096C2ZD01
Shaft ø 12 mm (other shaft diameters on request)

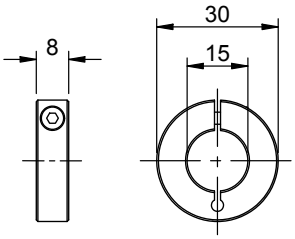
Dimensions in mm



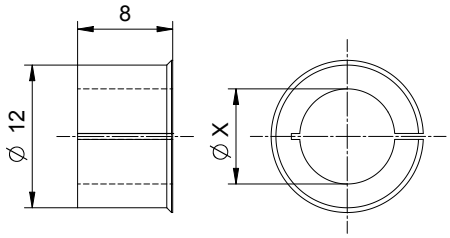


Maximum shaft length circulation of the torque support arm = 23,2 mm +0,2 mm (as shown)

Clamp ring (Aluminium)
(in scope of delivery)



Reducing bush (please order separatly)
Ordering code: ZRH-A-12-X
X = 6, 6,35, 8, 9,53, 10



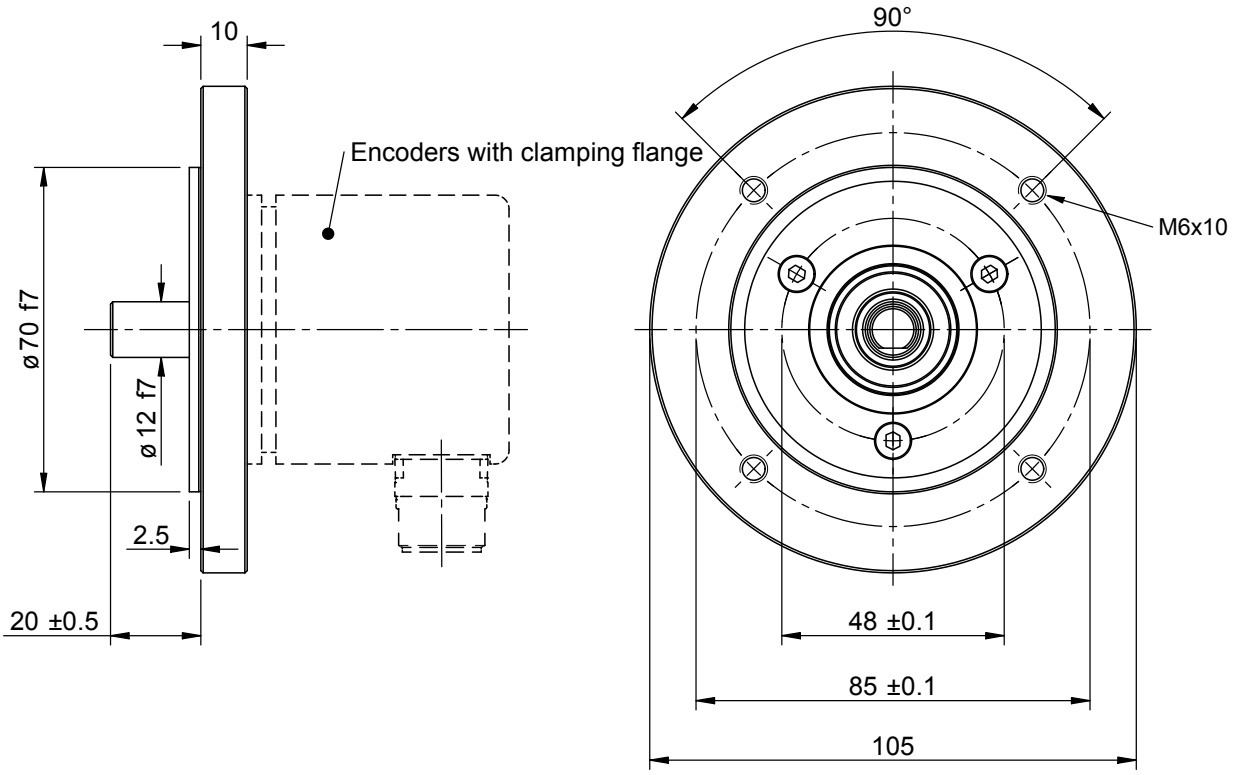
* 2x screws DIN 912 M4x30 (VA) plus 2x lock washer (VA) plus 2x washer DIN 9021-4.3.

** 3x screws DIN 912 M4x10 (VA) plus 3x lock washer (VA).

*** singleturn version 14 mm shorter

Absolute encoder TBD/TRD

Installation drawing

Design form 105, Order name: TRD105-MA4096R4096C2ZD01
Shaft ø 12 mm

Dimensions in mm